SECTION I.—AEROLOGY.

SOLAR AND SKY RADIATION MEASUREMENTS DURING AUGUST, 1916.

By HERBERT H. KIMBALL, Professor of Meteorology.

[Dated: Washington, D. C., Sept. 30, 1916.]

For a description of instrumental exposures, and an account of the methods of obtaining and reducing the measurements, the reader is referred to the Reviews for January, April, and May, 1916, 44:2, 179, 180, and 244.

The monthly means and departures from normal values given in Table 1 show that direct solar radiation intensities averaged slightly below normal at all stations except Lincoln, Nebr., the minus departures being most pronounced at Washington, D. C. At the latter station, however, a noon intensity of 1.43 gram-calories per minute per square centimeter, measured on the 14th, exceeds any previous August measurement at Washington by 2 per cent. A noon intensity of 1.42 gram-calories, measured at Lincoln on August 28, is likewise 2 per cent in excess of any August measurement of last year at that station.

Extrapolating to zero air mass, and reducing to mean solar distance of the earth, the radiation measurements obtained at Washington on August 14 give an intensity of 1.66 gram-calories, while those obtained at Santa Fe on August 31 give an intensity of 1.68 gram-calories—a very close agreement when we take into account the vapor-pressure differences shown in Table 2.

TABLE 1.—*Solar radiation intensities during August, 1916.*

[Gram-calories per minute per square centimeter of normal surface.]

Washington, D. C.

Date.	Sun's zenith distance. 0.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°
	Air mass. 1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
A. M.	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*
Aug. 8	1.03	0.73	0.51							
14	1.44	1.32	1.23	1.15	1.07	0.99				
17	1.20	0.90	0.69	0.52	0.42	0.35	0.30			
18	1.07	1.00	0.83	0.68	0.63	0.58				
19	1.20	1.03	0.88	0.74						
20	1.18	1.00	0.84	0.73	0.65					
22	1.22	1.05	0.83	0.77	0.67	0.58	0.51			
23		0.84								
24	1.35		0.86	0.76						
25	1.20	0.86	0.70	0.58	0.47	0.38				
26	1.10	0.99	0.87							
28	1.24									
31	1.09	0.92	0.72	0.58	0.50					
Monthly means	1.19	0.97	0.81	0.72	0.63	0.58	(0.40)			
Departure from 8-year normal	−0.03	−0.07	−0.06	−0.07	−0.07	−0.03	−0.03			
P. M.										
Aug. 14		1.31	1.21	1.11						
22		0.98	0.85	0.74	0.65	0.57				
24		1.15	0.98	0.83	0.69	0.57	0.49	0.41		
25		0.92	0.79	0.70	0.63	0.56	0.51	0.45	0.40	0.34
31		0.82		0.55						
Monthly means		1.04	0.96	0.79	0.66	0.57	0.50	(0.43)	(0.40)	(0.34)
Departure from 8-year normal		−0.03	+0.01	−0.01	−0.02					

TABLE 1.—*Solar radiation intensities during August, 1916*—Continued.

[Gram-calories per minute per square centimeter of normal surface.]

Madison, Wis.

Date.	Sun's zenith distance. 0.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°
	Air mass. 1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
A. M.	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*	*Gr.-cal.*
Aug. 8	1.19	1.05	0.92	0.81						
9		1.07	0.89							
11	1.31	1.21	1.11							
12		1.10	0.93	0.89	0.84					
16	1.24	1.07		0.83						
18	1.13	1.08	1.01	0.91	0.83					
23	1.36	1.22	1.11	1.02						
24	1.32	1.25	1.18	1.08	0.99	0.92	0.88	0.81		
25	1.39	1.27								
28		1.30	1.20	1.12	1.05	0.98				
29	1.34	1.21								
30		1.20	1.05	0.93	0.83					
Monthly means	1.28	1.17	1.04	0.95	0.91	(0.95)	(0.88)	(0.81)		
Departure from 7-year normal	−0.02	−0.01	−0.04	−0.06	+0.01	−0.09	+0.02	+0.03		
P. M.										
Aug. 18		1.09								
24			1.09							
25		1.28								
29		1.15	1.00	0.92	0.80					
30		1.08	0.95	0.85						
Monthly means		1.15	1.01	(0.88)	(0.80)					
Departure from 7-year normal		+0.02	+0.01	+0.01	+0.04					

Lincoln, Nebr.

A. M.										
Aug. 2		1.11								
3	1.23									
4		1.18	1.05	0.96	0.88	0.81	0.74			
12		1.12	1.06	0.94	0.84	0.77	0.72	0.69		
17		1.19	1.06	0.96	0.87	0.78				
18	1.33	1.23	1.10	1.03	0.91	0.85	0.73	0.68	0.66	
19	1.36	1.22	1.13	1.04						
23	1.39	1.23	1.12	1.00	0.89	0.81				
24	1.40	1.29	1.20	1.13	1.07	0.99	0.86	0.79	0.76	0.73
25				1.22	1.08	1.02	0.89			
28	1.46	1.35	1.25	1.18	1.11	1.05	0.99	0.93	0.90	0.87
29	1.31	1.21	1.12	1.03	0.95					
Monthly means	1.35	1.21	1.12	1.05	0.96	0.88	0.82	0.77	0.77	(0.80)
Departure from 2-year normal	+0.05	+0.06	+0.08	+0.08	+0.10	+0.09	+0.08	+0.11	+0.08	
P. M.										
Aug. 2		1.18	1.08	0.99	0.92	0.84	0.78			
3		1.13		0.91	0.83	0.76	0.68			
8			1.10	1.01	0.90	0.80	0.75			
10		1.12	1.04		0.83	0.79	0.74			
11			1.12	1.02	0.94	0.87	0.79			
12			0.86							
15			1.00	0.88	0.80	0.71	0.64			
17		1.15	1.02	0.90	0.83	0.76	0.69	0.63	0.58	
18		1.20	1.06	0.97	0.89	0.82	0.75	0.70	0.67	
19		1.16								
21		1.26	1.14	1.05	0.98	0.92	0.86	0.80	0.74	0.68
22			1.23	1.12	1.05	0.96	0.87	0.83	0.80	0.78
28		1.38	1.29	1.19	1.11	1.03	0.95	0.89	0.83	
Monthly means		1.20	1.09	1.00	0.92	0.84	0.77	0.77	0.72	0.73
Departure from 2-year normal		+0.03	+0.01	+0.01	+0.02	+0.01	+0.03	+0.05	+0.02	+0.03

TABLE 1.—*Solar radiation intensities during August, 1916*—Continued.

[Gram-calories per minute per square centimeter of normal surface.]

Santa Fe, N. Mex.

Date.	Sun's zenith distance.									
	0.0°	48.3°	60.0°	66.5°	70.7°	73.6°	75.7°	77.4°	78.7°	79.8°
	Air mass.									
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5
A. M.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.
Aug. 1	.....	1.35	1.23	1.19	1.16	1.11	.....	.....	.....	.....
7	.....	.....	1.07	1.00	0.93	0.87	.....	.....	.....	.....
9	.....	1.14	1.04	0.98	0.92	0.85	0.80	0.75	.....	.....
26	.....	.....	.....	.....	1.18	1.13	1.07	1.05	1.01	.....
28	1.44	1.30	1.24	1.20	1.15	.....	.....	1.03	1.00	.....
29	1.35	1.28	1.20	1.13	1.07	1.01	0.96	0.91	0.87	0.83
31	.....	1.40	1.33	1.26	1.19	1.13	1.08	1.04	1.00	0.97
Monthly means	(1.40)	1.29	1.18	1.13	1.09	1.02	0.98	0.96	0.97	(0.90)
Departure from 4-year normal	−0.03	−0.03	−0.04	−0.02	−0.01	−0.02	.....	.....	.....	.....

Sky-light polarization measurements made at Washington on nine days, with the sun at zenith distance 60°, give a mean of 50 per cent, and a maximum of 66 per cent on the 14th. This latter is only 1 per cent lower than the highest August polarization measurement ever obtained at Washington.

TABLE 2.—*Vapor pressures at pyrheliometric stations on days when solar radiation intensities were measured.*

Washington, D. C.			Madison, Wis.			Lincoln, Nebr.			Santa Fe, N. Mex.		
Dates.	8 a. m.	8 p.m.	Dates.	8 a.m.	8 p.m.	Dates.	8 a.m.	8 p.m.	Dates.	8 a.m.	8 p.m.
1916.	Mm.	Mm.	1916.	Mm.	Mm.	1916.	Mm.	Mm.	1916.	Mm.	Mm.
Aug. 8	19.89	20.57	Aug. 8	15.11	14.10	Aug. 2	17.96	18.59	Aug. 1	9.14	9.83
14	9.14	13.13	9	13.13	13.61	3	16.20	16.79	7	8.81	10.59
17	14.60	18.59	11	13.61	13.13	4	17.37	17.96	9	9.14	7.87
18	14.10	16.20	12	11.81	12.24	8	12.68	13.13	26	7.29	7.87
19	14.60	16.20	16	11.10	14.60	10	17.37	17.96	28	6.76	5.79
20	15.11	17.57	18	20.57	17.37	11	12.24	14.10	29	8.48	9.83
22	18.59	23.60	23	10.21	8.81	12	13.61	17.37	31	8.48	7.29
23	17.37	16.20	24	10.21	10.21	15	17.37	18.59			
24	11.81	13.61	25	8.48	8.81	17	18.59	19.23			
25	13.61	14.10	28	7.87	7.04	18	15.11	16.20			
26	16.20	17.37	29	8.48	9.14	19	15.11	16.79			
28	16.79	10.97	30	9.83	13.13	21	14.60	15.11			
31	14.10	16.20				22	10.59	10.59			
						23	9.14	11.81			
						24	10.59	11.38			
						25	10.59	10.97			
						28	8.18	7.04			
						29	7.04	11.38			

Table 3 shows a deficiency of radiation at Washington during the first half of August, which was more than made up by the excess during the second half. At Madison there was an excess of radiation for the month amounting to 7.8 per cent of the average August total. At Lincoln there was a deficiency of radiation during the second decade, but the departures from the normal were slight during the first and third decades.

TABLE 3.—*Daily totals and departures of solar and sky radiation during August, 1916.*

[Gram-calories per square centimeter of horizontal surface.]

Day of month.	Daily totals.			Departures from normal.			Excess or deficiency since first of month.		
	Washington.	Madison.	Lincoln.	Washington.	Madison.	Lincoln.	Washington.	Madison.	Lincoln.
	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.	Gr.-cal.
1	491	363	305	−1	−115	−215	−1	−115	−215
2	616	547	618	126	72	101	125	−43	−114
3	375	312	625	−113	−161	110	12	−204	−4
4	349	294	612	−137	−177	100	−125	−381	96
5	402	388	580	−82	−81	70	−207	−462	166
6	368	565	472	−113	99	−35	−320	−363	131
7	528	594	331	49	130	−174	−271	−233	−43
8	535	600	609	59	139	107	−212	−94	64
9	371	606	458	−103	148	−42	−315	54	22
10	502	212	517	31	−243	20	−284	−189	42
11	236	521	257	−233	69	−233	−517	−120	−196
12	477	446	509	11	−3	17	−506	−123	−179
13	332	648	208	−131	202	−281	−637	79	−460
14	668	349	132	207	−94	−355	−430	−15	−815
15	406	237	494	−52	−213	10	−482	−228	−805
16	125	541	359	−330	104	−123	−812	−124	−928
17	550	479	604	98	44	125	−714	−80	−803
18	529	563	610	79	131	134	−635	51	−669
19	562	478	603	115	49	129	−520	100	−540
20	556	531	477	111	105	6	−409	205	−534
Decade departure							−125	+394	−576
21	461	505	560	19	82	92	−390	287	−442
22	535	259	458	95	−101	−7	−295	126	−449
23	313	560	526	−124	143	63	−419	269	−386
24	576	550	568	141	136	108	−278	405	−278
25	521	551	438	89	140	−19	−189	545	−297
26	527	430	311	97	22	−144	−92	567	−441
27	469	592	613	42	186	160	−50	753	−281
28	445	567	599	20	164	148	−30	917	−133
29	420	543	533	−3	143	84	−33	1,060	−49
30	430	514	213	10	116	−234	−23	1,176	−283
31	474	281	132	56	−114	−313	33	1,062	−596
Decade departure							+442	+857	−62
Excess or deficiency since first of year	gr.-cal.						−6,454	+2,705	
	per cent.						−6.7	+2.8	

HIGH HAZE OVER THE SOUTHWESTERN UNITED STATES DURING JULY TO SEPTEMBER, 1916.

By HERBERT H. KIMBALL, Professor of Meteorology.

[Dated Weather Bureau, Washington, Oct. 2, 1916.]

The following is extracted from a communication by Mr. Ford A. Carpenter, in charge of the Weather Bureau office at Los Angeles, Cal., under date of September 7, 1916:

During the month of July, and especially during the latter part, red sunsets were common; but during the first decade of August both sunrises and sunsets were unusually brilliant. A note in the Daily Local Record describes a typical sunset as follows:

"*August 4, 1916.* Cloudy sunset. The sun set behind cirro-stratus clouds, which formed a low bank on the western horizon. As the sun set the western sky became lit with a yellow glow, which changed to orange, and finally to red."

A description is also given of brilliant sunrise and sunset colors that were observed from the top of Mount Wilson, Cal., on September 3 and 4, 1916, and Mr. C. G. Abbot of the Astrophysical Observatory of the Smithsonian Institution, who was then on Mount Wilson, is quoted as saying—

The presence of dust, probably volcanic, and which was responsible for the vivid colors of sunrise and sunset, greatly interfered with solar radiation work.